

## Project C5: Passenger and crew environments

### Researchers

Professor M.J. Griffin, Dr H.V.C. Howarth, Mr M.G.R. Toward (Southampton); Professor K.C. Parsons, Miss L. Kelly (Loughborough)

### Background

Passenger and crew comfort, performance, health and safety depend on a complex combination of reactions to noise, vibration, and the thermal environment. Current methods of evaluating the physical environment of passengers and crew are of variable quality. A simulator for reproducing the internal environment of railway carriages, including noise, vibration and thermal environment, has been developed. This will be used to improve methods for measuring, evaluating, and assessing passenger and crew responses to railway vehicle environments.



### Experimental studies

- Studies of the relative importance of motion, noise, seating and the thermal environment in trains and the interactions between these factors
- Use of the simulation facility for the study of specific questions raised by the rail industry
- Field studies of passenger responses to railway vehicle environments

### Design guides

- Further development of design guides for seating, vibration, noise, motion sickness and thermal environments in railway vehicles to reflect growing knowledge and in response to the needs of industry

### Progress

- Simulator design completed September 2006
- Draft design guides circulated September 2006
- New building completed April 2007
- Simulator installation June 2007
- Effects of vibration on keyboard operation completed 2007
- Acceptance of simulator December 2007
- Multi-axis vibration experimental studies 2008

### Novel Aspects

Unique simulator design and motion performance capability allows faithful recreation of the rail vehicle environment

### Specifications

The simulator has been designed to reproduce the motion, thermal and acoustic environment within trains. The moving platform is approximately 3 m by 3 m and can support payloads up to 1000 kg. The simulator is able to accurately reproduce motions in 6-axis with very low levels of background noise and waveform distortion.

**Frequency range:** 0 - 50 Hz

**Maximum displacements:** 1000 mm vertical; 500 mm horizontal

**Maximum rotations:** 20° roll and pitch; 10° yaw

**Maximum accelerations:** 10 m.s<sup>-2</sup> translation; 5 rad.s<sup>-2</sup> rotation

**Thermal:** temperature 10-30 °C; humidity 30-60%

**Acoustic:** virtual acoustic 3D imaging system

### Train environment simulator

A train environment (noise, vibration, thermal, lighting, seating, etc.) simulation facility has been developed to:

- Improve current methods by research in laboratory simulations
- Optimise specific environments



### Contact

Professor M.J. Griffin  
Human Factors Research Unit  
Institute of Sound and Vibration Research  
University of Southampton  
Southampton SO17 1BJ  
+44 (02380) 592277  
m.j.griffin@soton.ac.uk